

**SECTION 27 31 31**  
**VOICE COMMUNICATIONS SWITCHING AND ROUTING EQUIPMENT - EXTENSION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installing, certification, testing, and guaranty of a complete and operating extension of an existing operating Telephone System, and associated equipment (hereinafter referred to as "the System") and associated equipment to be installed in the VA Domiciliary hereinafter referred to as "the Facility". The System shall include, but not be limited to, necessary passive devices such as: protectors, isolators, splitters, couplers, cable "patch", "punch down", and cross-connector blocks or devices, cable management items, voice and digital cable distribution system, and associated hardware. The System shall additionally include, but not be limited to: telecommunications outlets (TCO); copper distribution cables, connectors, "patch" cables, and/or "break out" devices.
- B. The System shall be delivered free of engineering, manufacturing, installation, and operating defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
- C. The term "provide", as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.
- D. The Telephone System is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Therefore, if the System connects to or extends the telephone system, the System's installation and operation shall adhere to all appropriate National, Government, and/or Local Life Safety and/or Support Codes, whichever are the more stringent for this Facility. At a minimum, the System shall be installed according to NFPA, Section 70, National Electrical Code (NEC), Article 517 and Chapter 7; NFPA, Section 99, Health Care Facilities, Chapter 3-4; NFPA, Section 101, Life Safety Code, Chapters 7, 12, and/or 13; Joint Commission on Accreditation of Health Care Organizations (JCAHCO), Manual for Health Care Facilities, all necessary Life Safety and/or Support guidelines; this specification; and the original equipment manufacturer's (OEM) suggested installation design, recommendations, and instructions.

The OEM and Contractor shall ensure that all management, sales, engineering, and installation personnel have read and understand the requirements of this specification before the System is designed, engineered, delivered, and provided.

- E. The VA Contracting Officer (CO) and/or if delegated, Contracting Officer Technical Representative (COTR) are the approving authorities for all contractual and mechanical changes to the System. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the CO and/or the COTR before proceeding with the change.

## **1.2 RELATED WORK**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- D. Section 27 10 00, STRUCTURED CABLING.
- E. Section 26 27 26, WIRING DEVICES.
- F. Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
- G. H-088C3: VA HANDBOOK DESIGN FOR TELEPHONE SYSTEMS

## **1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. Except for a specific date given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date the system's submittal is technically approved by VA, shall be enforced.
- B. Joint Commission on Accreditation of Health Care Organizations (JCAHO): Comprehensive Accreditation Manual for Hospitals - Volumes One and Two.
- C. National and/or Government Life Safety Code(s): The more stringent of each listed code.
- D. National Fire Protection Association (NFPA):

No. 70	National Electrical Code (NEC)
No. 75	Protection of Electronic Computer/Data Processing Systems
No. 77	Recommended Practice on Static Electricity
No. 99	Standard for Health Care Facilities
No. 101	Life Safety Code
No. 1221	Emergency Services Communication Systems

E. Underwriter's Laboratories, Inc. (UL):

65	Wired Cabinets
467	Grounding and Bonding Equipment
497/497A/497B	Protectors for Paired Conductors/ Communications Circuits/Data Communications and Fire Alarm Circuits

F. ANSI/EIA/TIA PUBLICATIONS:

568B	Commercial Building Telecommunications
569B	COMMERCIAL BUILDING STANDARD FOR TELECOMMUNICATIONS PATHWAYS AND SPACES
598C	Optical Fiber Cable Color Coding
606A	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
607A	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
758	Grounding and Bonding Requirements for Telecommunications in Commercial Buildings

G. Lucent Technologies: Document 900-200-318 "Outside Plant Engineering Handbook".

H. International Telecommunication Union - Telecommunication  
Standardization Sector (ITU-T).

I. Federal Information Processing Standards (FIPS) Publications.

J. Federal Communications Commission (FCC) Publication: Standards for  
telephone equipment and systems.

K. United States Air Force: Technical Order 33K-1-100 - Test Measurement  
and Diagnostic Equipment (TMDE) Interval Reference Guide.

**1.4 QUALITY ASSURANCE**

A. The authorized representative of the System's OEM shall be responsible  
for the design, satisfactory total operation of the System, and its  
certification.

- B. The OEM shall meet the minimum requirements identified in Paragraph 2.1.A. The Contractor shall have had experience with three or more installations of systems of comparable size and complexity with regard to coordinating, engineering, testing, certifying, supervising, training, and documentation. Each of these installations shall have been in successful operation for a minimum of three years after final acceptance by the user. Details of these installations shall be provided as a part of the submittal identified in Paragraph 1.5.
- C. The System Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The System Contractor shall be authorized by the OEM to certify and warranty the installed equipment. In addition, the OEM and System Contractor shall accept complete responsibility for the design installation, certification, and physical support for the System. This documentation, along with the System Contractor and OEM certifications must be provided in writing as a part of the Contractor's Technical Submittal.
- D. The Contractor's Telecommunications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the Contracting Officer Technical Representative before being allowed to commence work on the System.

#### **1.5 SUBMITTALS**

- A. On-Site Survey: The Contractor shall provide an on-site telephone equipment location, cable pathway, TC, TCO, and interconnection survey with the submittal that is accomplished no later than 6 months prior to the expected completion of the facility.
  - 1. The survey will be accomplished by a physical walk through of the facility and existing locations with the contract drawings (including all approved changes) and existing survey performed by the IRM department. Differences in locations between the two surveys shall be clearly identified and shall be provided to the COTR in writing within 30 days of the completion of the survey.
- B. Provide submittals in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. The COTR shall retain one copy for review and approval.

1. If the submittal is approved, the COTR shall retain one copy for Official Records and return three (3) copies to the Contractor.
  2. If the submittal is disapproved, three (3) copies will be returned to the Contractor with a written explanation attached indicating the areas where the submittal deviated from the System Specifications. The COTR shall retain one copy for Official Records.
- C. Documents: The submittal shall be separated into sections for each subsystem and shall contain the following:
1. Title page to include:
    - a. VA Medical Center.
    - b. Contractor's name, address, and telephone (including fax) numbers.
    - c. Date of Submittal.
    - d. VA Project No.
  2. List containing a minimum of three (3) locations of installations of similar size and complexity as identified herein. These locations shall contain the following:
    - a. Installation Location and Name.
    - b. Owner's or user's name, address, and telephone numbers (including fax).
    - c. Date of Project Start and Date of Final Acceptance by Owner.
    - d. System Project Number.
    - e. Brief (three paragraphs minimum) description of each system's function, operation, and installation.
  3. Narrative: Description of the System as it is expected to be installed.
  4. A list of equipment to be furnished. The quantity, make and model number of each item is required.
  5. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.
  6. Engineering drawings of the System, showing calculated signal levels at the CSU output, each input and output distribution point, proposed telephone outlet values, and signal level at each telephone outlet multipin jack.
  7. List of test equipment as per paragraph 1.5.D below.
  8. A letter certifying that the Contractor understands the requirements of the "Samples" paragraph 1.5.E below.

9. A letter certifying that the Contractor understands the requirements of Section 3.2 concerning acceptance tests.
- D. Test Equipment List. The Contractor is responsible for furnishing all test equipment required to test the System in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of an accuracy better than the parameters to be tested. The test equipment furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 3 months prior to the test. As part of the proposal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:
  1. Spectrum Analyzer.
  2. Signal Level Meter.
  3. Volt-Ohm Meter.
  4. Time Domain Reflectometer (TDR) with strip chart recorder.
  5. Bit Error Test Set (BERT).
- E. Samples. A sample of each of the following items shall be furnished to the Contracting Officer Technical Representative for approval prior to installation. The samples may be returned to the Contractor at the discretion of the COTR.
  1. TCO Wall Outlet Box 100 mm x 100 mm x 63 mm (4" x 4"x 2.5") with:
    - a. One each telephone (or voice) RJ45 jack installed.
    - b. Two each multi pin data RJ45 jacks installed.
    - c. Cover Plate installed.
  2. Data CCS patch panel, punch block or connection device with RJ45 connectors installed.
  3. Telephone CCS system with IDC and/or RJ45 connectors and cable terminal equipment installed.
- F. Certifications:
  1. Submit written certification from the OEM indicating that the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individuals' exact names, addresses, and OEM credentials in the certification.

2. Submit written certification from the OEM that the wiring and connection diagrams meet National and/or Local (whichever is the more stringent) Life Safety Guidelines, NFPA, NEC, UL, this Specification, and JCAHCO requirements and instructions, and the requirements, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. The VA will not approve any submittal without this certification.
  3. Preacceptance Certification: This certification shall be made in accordance with the Test Procedure paragraph 3.2.B.
- G. Equipment Manuals: Ten (10) working days prior to the scheduled acceptance test, the Contractor shall deliver four (4) complete sets of commercial operation and maintenance manuals for each item of equipment furnished as part of the System to the Contracting Officer Technical Representative. The manuals shall detail the theory of operation and shall include narrative descriptions, pictorial illustrations, block and schematic diagrams, and parts lists.
- H. As-Installed Equipment and Wiring Diagrams: Fifteen (15) working days prior to the scheduled acceptance test, the Contractor shall deliver four complete sets of the Record Wiring Diagrams of the System to the COTR. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, equipment and room/area locations. The drawings shall show the signal levels of the telephone aural carriers of each telephone channel at the input and output of all electronic equipment, beginning and end of each distribution line, and the telephone outlets. The record wiring diagrams shall be provided in hard copy and two compact disk copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AUTO CAD) system. The Contracting Officer Technical Representative shall verify and inform the Contractor of the current version of AutoCAD being used by the Facility. The Contracting Officer Technical Representative shall submit one hard copy of each as-installed drawing to TSSO-005N2 for review 15 working days prior to the scheduled acceptance test.

- I. Ten (10) days prior to the start of the intermediate test, provide a typewritten detailed description of the System testing plan that meets this Specification's performance standards as indicated in section 2.1 including illustrations, and utilizes test equipment specified in paragraph 1.5.D. The test plan will need to be evaluated and approved by the COTR before intermediate testing begins.
- J. Needs Analysis (required for extension of existing system): The Contractor shall conduct a needs analysis of the existing Facility with representatives from the IRM and various departments to determine the System's requirements. The analysis shall depict System features and capacities, in addition to specific site requirements. The analysis shall be typewritten and contain the following information as a minimum:
1. Cable Distribution System: A design plan for twisted pair distribution cable plant requirements is not included in this document. However, the Contractor is required to formulate a projected cable count that shall coincide with the Maximum Growth items described herein. It is the Contractor's responsibility to provide the System's CCS, cable distribution, and TCO requirements in order to develop a copper distribution requirements plan using the following paragraphs as an example:
- a. Twisted Pair Requirements/Column Explanation:

Column	Explanation
From Building	Identifies the building by number or title
Floor	IDENTIFIES THE FLOOR BY NUMBER (I.E. 1ST, 2ND, ETC.)
Room Number	Identifies the room, by number, from which cabling shall be installed
Number of Cable Pair	Identifies the number of cable pair required to be terminated on the floor designated or the number of cable pair (VA Owned) to be retained
Building	Identifies the building by number or title
Room	Identifies room



2. Telecommunication Outlets (TCO). The Contractor shall clearly and fully indicate this category for each outlet location and compare the total count to the locations identified and as shown on the Drawings as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT AND MATERIALS**

#### **A. System Requirements:**

1. The System shall extend the following minimum services generated by the existing telephone system. If these services are not generated by an operating existing telephone system, the System shall be fully compatible and capable of providing them in accordance with and supported by an Original Equipment Manufacturer (OEM), and as specified herein. The System shall provide continuous inter- and/or intra-Facility service. The System shall be capacity sized so that loss of connectivity to an external telephone system(s) shall not affect the Facility's operation in specific designated emergency operating locations and instruments. The System shall:
  - a. Inter-operate, connect, and function fully with the existing Local Telephone Exchange (LEC) Network(s), Federal Telephone System (FTS), Inter-city Network(s), Inter-exchange Carriers, Integrated Services Digital Network (ISDN), at a minimum.
  - b. Inter-operate with current identified voice mail and automatic attendant functions, and as required as specified herein.
  - c. TCO(s) shall be provided as indicated on Drawings and shall be supplied with an associated (within 305 mm (one foot)) or attached active duplex 120 Volts Alternating Current (VAC) outlet (using a quad receptacle box for the TCO and a separate duplex receptacle box for the AC outlet).
- 1) The Contractor shall provide the TCOs that consist of one telephone multipin and two data multipin jacks, each meeting Category 5 level of service. The telephone multipin jack shall be interfaced and connected to the System via a terminal punch block in each associated TC.

- 2) The telephone system Contractor shall connect each data multipin jack to a separate data system approved terminating patch panel device in each associated TC. The telephone system Contractor is not to install active data distribution equipment to the System or cross connect the data systems.
  - d. The System shall be designed to minimize cross talk, background processor noise, inter-modulation, and other signal interference. The equipment shall be installed and interfaced according to the OEM schematic diagram for adjacent audio channel operation. Each audio input channel shall be processed as a single separate channel and combined into one output channel.
2. Point of Telephone System Interface:
- a. The telephone signals shall be acquired at the existing telephone EPBX equipment cabinet or as designated in the telephone switch room TC. The Contractor is not responsible for the condition of the telephone signals of the existing telephone system. If the telephone signals at the interface point do not meet the minimum signal level and quality as stated herein, the Contractor shall notify the COTR, in writing, detailing the nature of the deficiencies, and the expected effect on the telephone signals in the new extension system. The COTR will coordinate with the Facility Engineering Officer so the necessary repairs for the identified deficiencies can be accomplished.

B. General:

1. All equipment to be supplied under this Specification shall be new and the current model of a standard product of an OEM of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
  - a. Maintains a factory production line for the item submitted.
  - b. Maintains a stock of replacement parts for the item submitted.
  - c. Maintains engineering drawings, specifications, and operating manuals for the items submitted.
  - d. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least one year prior to the Invitation for Bid.

2. Specifications of equipment as set forth in this document are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the System. When the Contractor furnishes an item for which there is a specification contained herein, the item shall meet or exceed the specification for that item of equipment.
3. The Contractor shall produce verification, in writing, to the COTR at time of installation, that the type of wire/cable actually being provided is recommended and approved by the OEM and will provide a total system free of undesirable effects. The Contractor is responsible for providing the correct protection cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.
4. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.
5. All interconnecting twisted pair cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, or splice blocks, and unused equipment ports/taps shall be terminated according to the OEM's instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair cable unterminated, unconnected, loose or unsecured.
6. All distribution voltages, except for the primary AC power to the power supply circuits, shall not exceed 30V AC Root Mean Squared (RMS) or 42V direct current (DC).
7. Color code all distribution wiring to conform to the Telephone Industry standard, ANSI/EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record wiring diagrams, to facilitate installation and maintenance. Reference Specification Section 27 10 00, STRUCTURED CABLING.

8. Plug-in connectors shall be provided to connect all equipment, with the exception of interface points. Baseband cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.
9. All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cycolac plastic that matches the equipment item where it is installed. All faceplates shall be constructed of the same material throughout the Facility.

## **2.2 EQUIPMENT SPECIFICATIONS**

### **A. Cross-Connection System (CCS) Equipment Breakout, Termination Connector (or Bulkhead), and Patch Panels:**

1. The connector panel(s) shall be made of flat smooth 3.175 mm (1/8 inch) thick solid aluminum, custom designed, fitted and installed in the cabinet. Bulkhead equipment connectors shall be mounted on the panel to enable all cabinet equipment's signal, control, and coaxial cables to be connected through the panel. Each panel shall be color matched to the cabinet installed.

#### **a. Voice (or Telephone):**

- 1) The CCS for voice or telephone service shall be Industry Standard 110 type punch blocks. This represents the minimum requirement for voice or telephone, and control wiring in lieu of patch panels, each being certified for Category six service. IDC punch blocks (with internal RJ45 jacks) are acceptable for use in all CCS and shall be specifically designed for Category six telecommunications service and the size and type of UTP cable used as described herein. As a minimum, punch block strips shall be secured to an OEM designed physical anchoring unit located on a wall in the MTC, IMTC, and TC. However, console, cabinet, rail, panel, etc. mounting is allowed at the OEM's recommendation and as approved by the COTR. Punch blocks shall not be used for Class II or 120 VAC power wiring.

2) Technical Characteristics:

Number of horizontal rows	100, minimum
Number of terminals per row	4, minimum
Terminal protector	required for each used or unused terminal
INSULATION SPLICING	required between each row of terminals

b. Mounting Strips and Blocks:

1) Barrier Strips:

- a) Barrier strips are approved for AC power, data, voice, and control cable or wires. Barrier strips shall accommodate the size and type of audio spade (or fork type) lugs used with insulating and separating strips between the terminals for securing separate wires in a neat and orderly fashion. Each cable or wire end shall be provided with an audio spade lug, which is connected to an individual screw terminal on the barrier strip. The barrier strips shall be surface secured to a console, cabinet, rail, panel, etc. 120 VAC power wires shall not be connected to signal barrier strips.

b) Technical Characteristics:

Terminal size	6-32, minimum
Terminal Count	Any combination
Wire size	20 AWG, minimum
Voltage handling	100 V, minimum
Protective connector cover	Required for Class II and 120 VAC power connections

- 2) Solderless Connectors: The connectors (or fork connectors) shall be crimp-on insulated lug to fit a 6-32 minimum screw terminal. The fork connector shall be installed using a standard lug-crimping tool.

- 3) Punch Blocks: Industry Standard 110 type punch blocks are approved for data, voice, and control wiring at a minimum. Punch blocks shall be specifically designed for the size and type of wire used. Punch block strips shall be secured to a console, cabinet, rail, panel, etc. Punch blocks shall not be used for Class II or 120 VAC power wiring.
- 4) Wire Wrap Strips: Wire wrap strips (minimum of 1.65 mm (0.065") wire wrap) are approved for voice and control wiring and shall meet Industry Standards. Wire wrap strips shall be secured to a cabinet, rail, panel, etc. Wire wrap strips shall not be used for Class II or 120VAC power wiring.

B. Wire Management System and Equipment:

1. Wire Management System: The system(s) shall be provided as the management center of the respective cable system, CCS, and TC it is incorporating. It shall perform as a platform to house peripheral equipment in a standard relay rack or equipment cabinet. It shall be arranged in a manner as to provide convenient access to all installed management and other equipment. All cables and connections shall be at the rear of each system interface to IDC and/or patch panels, punch blocks, wire wrap strips, and/or barrier strip.
2. Wire Management Equipment: The Wire Management equipment shall be the focal point of each Wire Management system. It shall provide an orderly interface between outside and inside wires and cables (where used), distribution and interface wires and cables, interconnection wires and cables and associated equipment, jumper cables, and provide a uniform connection media for all system fire retardant wires and cables and other subsystems. It shall be fully compatible and interface to each cable tray, duct, wireway, or conduit used in the system. All interconnection or distribution wires and cables shall enter the system at the top (or from a wireway in the floor) via an overhead protection system and be uniformly routed down either side (or both at the same time) of the frame in side protection system then laterally via an anchoring or routing shelf for termination on the rear of each respective terminating assembly. Each system shall be custom configured to meet the system design and user needs.

## **2.3 DISTRIBUTION EQUIPMENT AND SYSTEMS**

- A. The System shall be provided with a complete building distribution system consisting of copper cable and connectors, cross connection or terminating systems, telecommunication outlets and interface points.
- B. Horizontal and Station Cable:
  - 1. A Four UTP 24 AWG station wiring cable shall be installed from the top TCO jack to the TC and shall be of a type designed to support Category 6 communications (250 mega-Hertz [mHz] or above). At the jack location, terminate all four pairs on the RJ-45/11 jack. At the signal closet, all four pairs shall be terminated on the modular punch down blocks dedicated to telephone applications.
  - 2. A Four (4) UTP AWG (in thermoplastic jacket unless otherwise specified by COTR) station wiring cable shall be installed from each of the two (2) bottom TCO RJ-45 jacks (shall conform to EIA/TIA 568 Standard "T568A" and NFPA) to the TC and shall be of a type designed to support Category 6 communications (250 mHz or above).
- C. Telecommunication Outlets (TCO), Jacks: All TCO's shall have a minimum of two (2) RJ-45 type jacks. The top jack shall be an eight pin RJ-45/11 compatible jack, labeled, and designated for telephone applications only. The bottom jack shall be eight pin RJ-45 type unkeyed (sometimes called center keyed) jack, labeled, and designated for data.

## **2.4 INSTALLATION KIT**

- A. The kit provided shall include, at a minimum, all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. The Contractor shall turn over all unused and partially opened installation kit boxes, coaxial and twisted pair cable reels, conduit, cable duct bundles, wire rolls, and physical installation hardware to the COTR. At a minimum, the following installation sub-kits are required:
- B. System Grounding:
  - 1. The grounding kit shall include all cable and installation hardware required.

2. This includes, but is not limited to:
  - a. Coaxial Cable Shields
  - b. Control Cable Shields.
  - c. Data Cable Shields.
  - d. Conduits.
  - e. Cable Duct.
  - f. Connector Panels.
  - g. Grounding Blocks.
- C. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
- D. Conduit and Cable Duct: The kit shall include all conduit, duct, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, and other hardware required to accomplish a neat and secure conduit and/or cable duct installation in accordance with the NEC and this document.
- E. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
- F. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, Record Wiring Diagrams, and this document.
- G. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Product Delivery, Storage and Handling:
  1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment model and serial identification numbers. The COTR may inventory the equipment.



2. Storage and Handling: Store and protect equipment in a manner that will preclude damage as directed by the COTR.

B. System Installation:

1. After award of Contract, and within the time period specified in the Contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this Specification. The Contractor shall make no substitutions or changes in the system without written approval from the Contracting Officer Technical Representative.
2. The Contractor shall install all equipment and systems in a manner which complies with accepted industry standards of good practice, the requirements of this Specification and in a manner that does not constitute a safety hazard. The Contractor shall insure that all installation personnel understand and comply with all the requirements of this Specification.
3. The Contractor shall install suitable filters, traps, directional couplers, splitters, telephone outlets, and pads for minimizing interference and for balancing the amplifiers and distribution system(s). Items used for balancing and minimizing interference shall be able to pass telephone channels in the frequency bands selected, in the directions specified, with low loss, and high isolation and with minimum delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements of section 2.1 and the System performance standards.
4. All passive equipment shall be connected according to the OEM's specifications to insure correct termination, isolation, impedance match and signal level balance at each telephone outlet.
5. All lines shall be terminated in a suitable manner to facilitate future expansion of the System.
6. Terminating resistors or devices shall be used to terminate all unused branches, outlets, and equipment ports of the System, and shall be devices designed for the purpose of terminating twisted pair cables carrying digital and analog signals in telephone systems.

C. Conduit, Cables and Wiring, Raceways, Signal Ducts, Etc.:

1. The Contractor shall employ the latest installation practices and materials.

2. All cables shall be installed in conduit and/or signal ducts.  
Conduits shall be provided in accordance with Section 27 05 33,  
RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
3. Ensure that Telephone Systems (as identified by NEC Section 517) are  
completely separated and protected from all other systems.
4. All cable junctions and taps shall be accessible. Do not install  
multi-taps or other distribution equipment items inside cable ducts  
or raceways. As a minimum, use a 200 mm x 200 mm x 100 mm (8" X 8" X  
4") junction box attached to the cable duct or raceway for  
installation of distribution system passive equipment. Ensure that  
all equipment and tap junctions are accessible.
5. Cables shall be installed and fastened without causing sharp bends  
or rubbing of the cables against sharp edges. Cables shall be  
fastened with hardware that will not damage or distort them.
6. Cables shall be labeled with permanent markers at the terminals of  
the electronic and passive equipment and at each junction point in  
the System. The lettering on the cables shall correspond with the  
lettering on the record wiring diagrams.
7. Cable shall be grouped and shall not change position throughout the  
cable run.
8. Completely test all of the cables after installation and replace any  
defective cables.

### **3.2 TESTS**

- A. This document is being used as a "Stand Alone" cable plant  
installation; the following testing guidelines shall be the standard of  
measure for the respective system.
- B. Interim Inspection:
  1. The interim inspection will be conducted in the presence of a  
Government Representative designated as the VA Contract Coordinator  
prior to the proof of performance testing. This inspection shall  
verify that the equipment provided adheres to the installation  
requirements of this document.
  2. The Contractor shall have 50% of the telephone extension system  
equipment installed to include, but not be limited to: interface,  
origination and junction enclosures, outlets, conduit and cables,  
before the interim inspection can take place.

3. The Contractor shall notify the Contracting Officer Technical Representative, in writing, of the estimated date the Contractor expects to be ready for in the interim inspection, at least 7 working days before the requested inspection date.
  4. Results of the interim inspection shall be provided to the Contracting Officer Technical Representative. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the System installation.
  5. The Contracting Officer Technical Representative, in conjunction with Project Engineer, shall determine if an additional inspection is required, or if the Contractor will be allowed to proceed with the installation. In either case, re-inspection of deficiencies noted during the interim inspection(s), will be part of the proof of performance test. The interim inspection shall not affect the System's completion date. The Contracting Officer shall ensure all test documents will become a part of the System's record wiring diagrams documentation.
- C. Pretesting: Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.
- D. Pretesting Procedure: During the System pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the System performance requirements of this document. The Contractor shall measure and record the aural carrier levels of each system telephone, at each of the following points in the system:
1. Signal Level at each interface point to the distribution system, the last outlet on each trunk line plus all outlets installed as part of this Contract.
  2. A copy of the recorded system pretest measurements shall be submitted, along with the pretest certification, to the COTR.

E. Pretesting Certification. After pretesting the System, the Contractor shall notify the COTR, in writing, that the System is ready for proof of performance testing, and that it meets all requirements stated in this document. The Contractor shall accomplish submission of this notification of system readiness no later than 20 working days prior to the beginning of the scheduled Government proof of performance test. Failure of the Contractor to comply with these pretest requirements shall be grounds for canceling the scheduled test.

F. Acceptance Test:

1. After the System has been pretested and the Contractor has submitted the pretest results and certification to the COTR, the Contractor shall schedule an acceptance test date and give the COTR 20 days advance written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a Government Representative and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance. The test shall verify that the total system meets all the requirements of this Specification. The notification of the acceptance test shall include the expected length (in time) of the test.
2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed System complies with the operational and technical requirements of this Specification under operating conditions. The System shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to effect repairs shall cause the entire System to be declared unacceptable. Re-testing of the entire System shall be rescheduled at the convenience of the Government.

G. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:

- a. The Government Representative will tour all major areas where the System is and all sub-systems that are completely and properly installed to insure that they are operationally ready for proof of performance testing. A System inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
- b. The System diagrams, record drawings, equipment manuals, Auto CAD disks, interim inspection and pretest results shall be formally inventoried and reviewed.
- c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.

2. Operational Test: After the Physical and Mechanical Inspection, the Contractor shall perform an operational test to verify that all equipment is properly connected, is interfaced, and is functionally operational to meet the requirements of this Specification. If any sub-system is not functionally ready, that sub-system shall be declared unacceptable and all testing shall be terminated. At this point, the Contractor shall be permitted one hour to correct the deficiencies. It may be mutually agreed upon, at this time, to wait one hour or to commence testing of the next sub-system.

3. Performance Test: After the functional test, each sub-system shall be checked to verify that all performance requirements and standards are met. The performance requirements shall be verified using the necessary test equipment. A spectrum analyzer, signal level meter and BERT shall be used to verify there are no visible signal distortions, such as inter-modulation, beats, etc. appearing on any received or generated telephone channel.

4. Individual Item Test: The Government Representative may select individual items of equipment for detailed proof-of-performance testing. That item shall meet or exceed the minimum requirements of the Specification.

5. Distribution System:

- a. To ensure that the System meets all performance requirements, a minimum of 75% of the System outlets shall be checked.

Additionally, each distribution system interface, junction and connection point or location will be checked. Each distribution passive item of equipment, signal input(s) and output(s) will be tested.

**3.3 SYSTEM GUARANTEE**

- A. Contractor's Responsibility: The Contractor shall guarantee that all installed material and equipment will be free from defects in workmanship, and will remain so for a period of one year from date of final acceptance of the System by VA. The Contractor shall provide OEM's equipment warranty documents to the COTR and Facility Contracting Officer, certifying that all equipment installed under this document conforms to its published specifications.
- B. The Contractor shall provide a written commitment from the System equipment OEM to the supply of parts and on-site engineering support services for the one year guarantee service (materials and labor) in the event of default or unsatisfactory service by the Contractor.
  1. The OEM certification shall describe, in the event of default or unsatisfactory service by the Contractor, that manufacturer or an authorized distributor shall fully support the contract (initial installation, guarantee service for the one year warranty period of the Contract).
  2. The System equipment OEM's signatory of the certified written commitment must be of an individual who has the full authority to obligate the OEM to this commitment. Names, corporate addresses, and telephone numbers of the individuals who have this authority shall be provided as a part of the commitment.
- C. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM's central emergency maintenance and request remote diagnostic testing and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
- D. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of their current and qualified OEM training certificates and OEM certification upon request.

E. Additionally, the Contractor shall accomplish the following minimum requirements during the one year guarantee period:

1. Response Time:

- a. The COTR or the Facility Contracting Officer (if the Facility has taken possession of the building[s]) are the Contractor's reporting and contact officials for the System trouble calls, during the guarantee period.
- b. A standard workweek is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal Holidays.
- c. The Contractor shall respond and correct on-site trouble calls, during the standard work week, to:
  - 1) A routine trouble call within one working day of its report. A routine trouble is considered a trouble that causes a sub-system to be inoperable.
  - 2) An emergency trouble call within eight (8) hours of its report. An emergency trouble is considered a trouble that causes a system to be inoperable at any time.
    - a) An emergency trouble call shall be deemed appropriate when a failure involves more than 20 voice circuits.
  - 3) The Contractor shall respond on-site to installation of station or equipment requests or service within:
    - a) Eight (8) hours for emergency installations designated by the Facility Contracting Officer, and
    - b) Three working days for routine installations designated by the Facility Contracting Officer.

~~2. Government Furnished Equipment (GFE). GFE that was accepted by the Contractor and interfaced and installed in this System shall become part of this System and be included in the guarantee requirements.~~

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